CUTTING MACHINE FOR PACKAGE MANUFACTURING

BACKGROUND OF THE INVENTION

[0001] The present invention relates to cutting machines for use in blister pack manufacturing lines. More specifically, the present invention relates to interchangeable automated blister pack cutting machines with user customizable cutting lengths and programmable features.

[0002] For fragile products such as, for example, pharmaceuticals, foods, or electronics, blister packs are a desirable packaging. Many blister packs consist of multi-layered packaging including a plastic sheet with formed pockets (or blisters) in which the end product is packaged, and an adhered backing material such as, for example, a metal, a paper, another plastic, or a combination of these backing layers.

[0003] Blister packs are traditionally made through a five-step process on a blister pack manufacturing line, including the steps of forming, filling, sealing, perforating, and cutting. First, a sheet or "web" of polyvinyl chloride ("PVC") plastic is heated to thermoform blister "bubbles" in the PVC. Second, the end product to be packaged is placed in the blisters formed in the PVC. Next, the filled blisters on the web are sealed using an adhesive-lined backing material such as aluminum with adhesive thereon.

[0004] Then, in most manufacturing lines, the resulting web of filled blisters is perforated in order to make each blister separable by the end-user of the blister pack. Finally, the fully processed web of filled blister packaging is cut into the shape of the final product for final packaging. Often, separate machines along the blister pack manufacturing line perform these five steps of forming, filling, sealing, optionally perforating and cutting.

[0005] Existing machines for forming, filling, sealing and perforating are well known to those of skill in the art. In

some blister pack manufacturing systems, the forming, filling, sealing, perforating and cutting machines are coupled together via an electrical control system. The electrical control system provides signals to the machines to start operation, stop operation, and to move material at an index rate at which web advances through the blister pack manufacturing system.

[0006] Electrical control can be electrical relay based or mechanically controlled. In electrical relay systems, electrical signals control the machines on the blister pack manufacturing line in parallel. In mechanically controlled blister pack manufacturing systems, there is only a mechanical control system, wherein the index rate is determined by mechanical means, and simultaneous operation of the machines in the system is controlled mechanically. Generally, in all of these systems, the signals to all machines will be similar, such that the machines will operate at the same index rate.

[0007] The machines in the blister pack manufacturing line are usually sold, used and maintained as a single unit. The machines for each step in the manufacturing line typically work at nearly same rate, such that the operation of the blister pack manufacturing line is limited by the slowest machining station on the line as a limiting, slowest step.

[0008] A cutting machine typically performs the final cutting step. These machining stations typically include a mechanism to move the web through the cutting machining station, some type of cutting mechanism such as a die cast or guillotine, and optionally include sensors and/or calibration mechanisms to ensure accuracy in cutting of the completed web.

[0009] Although the use of die cast is common in blister pack cutting, the cookie-like cutting of die casts often leaves a great deal of waste blister pack material. Other cutting machines use a knife or guillotine, but such guillotine based systems require careful control of both the guillotine and the blister pack web to maintain clean cuts of the blister pack at predetermined locations.

[0010] In addition, due to the physical limitations of die casts, substantial retooling and recalibration of the cutting machining station is necessary in order to change the shape and quantity of final blister packs cut by a blister pack cutting machining station. Whatever the cutting mechanism used by the cutting machining station, the final blister packs cut by the cutting station are limited in size by the amount of material passed through the cutting station at any one time.

[0011] Two types of blister pack manufacturing lines are often used to improve blister pack manufacturing efficiency. "Continuous" machines generally move web through all five machines in the manufacturing line at a continuous rate, such that the five steps of forming, filling, sealing, perforating and cutting occur continuously while the blister pack web moves through the individual machining stations.

[0012] Alternatively, "intermittent" machines generally move a predetermined length of blister pack web into each of the forming, filling, sealing, perforating, and cutting machining station. Then each of the machining stations operates on part of the web during the dwell cycle following indexing. After all operations are complete, the intermittent machining line moves, or "indexes," another predetermined amount of web under the machining stations, in a step-and-repeat fashion, until the entire web to be made into blister packs has been machined. While there are numerous variations on both intermittent lines and continuous lines, most machines fall into one of these two categories.

[0013] Preferably, an index rate is measured by a repeatable, measured distance of which the web material is forwarded on the blister pack manufacturing system during each cycle of the system. In alternate embodiments, the index rate may comprise a desired length of web material per unit time. .Alternatively, an index rate is determined by the number of full cycle operations performed by a machining station of a

blister pack manufacturing line in one minute. Multiplied by the length of blisters formed in web material in each machining (or index) cycle, the total length of web material machined per minute can thus be readily determined. In many blister pack machining systems, the index rate is determined by the operation of the forming machining station – sometimes the smallest or slowest station in the blister pack manufacturing system.

[0014] Intermittent machines typically range in speed from about 15 cycles per minute to about 50 cycles per minute. However, as the number of cycles per minute increase, the number of blisters formed per cycle typically decrease. Lengths of web material operated on in each index range from an inch to many inches, depending on the size of the machines in the blister pack manufacturing line.

[0015] The index rate of web material advanced through a blister pack machining system in each cycle is generally predetermined and set, either electrically or mechanically, for the system prior to operation. The index rate is typically set mechanically via a mechanical cam which is set prior to operation of the machining system, and which is generally limited to the range in which all the machining stations on the machining system can operate. A few machines have index rates set by an electrically controlled servo mechanism, but these machines are also limited to the range in which all the machining stations on the machining system can operate.

[0016] The web material is conveyed from one station to another via a conveyor or web advance assembly, which use friction wheels, air flow or suction, a conveyor surface, or other similar well known techniques for moving web material on the blister pack manufacturing system line.

[0017] In either intermittent or continuous blister pack manufacturing systems, the speed of blister pack manufacturing is typically limited by the rate of processing of each of the

machining stations, and the amount of blister pack web the physical construction of each machining station can work on at any one time. Thus, in intermittent blister pack manufacturing lines, the rate of manufacturing is typically limited to the index rate of the slowest machining station on the blister pack manufacturing line. The blister pack index rate may also be limited by the smallest machining station on the blister pack manufacturing line, in that the smallest machining station requires the blister pack web to be indexed at a lesser rate than could be used by other machining stations on the blister pack manufacturing line.

[0018] As a result, the index rate of the intermittent blister pack machining line, as sometimes determined by the slowest or smallest machining station on the blister pack manufacturing line, substantially limits the size and quantity of final blister packs that can be made by a blister pack cutting machining station. In particular, on a traditional blister pack manufacturing line the cutting station is limited by the size of each indexing step, such that a required small indexing step limits the maximum blister pack size to be cut. This limitation restricts the size and shape of final blister packs a cutting station can make without need for substantial and expensive retooling and recalibration of the entire blister pack manufacturing line.

SUMMARY OF THE INVENTION

[0019] The present invention solves the shortcomings of prior art blister pack machines by providing a blister pack cutting station that allows the cutting of final blister packs of substantially any size, without the need for retooling and recalibration of the entire blister pack manufacturing line. In particular, by providing an intermittent blister pack cutting station with one or more of: (1) its own second index rate, (2) a web compensation loop, and (3) a user programmable cutting station processor, the cutting station can thereby cut blister packs of a wide variety of sizes through direct user selection at the cutting station.

[0020] Advantages of the present system involve, but are not limited to, eliminating significant retooling or recalibration of the cutting apparatus, eliminating the need to adjust the rest of the blister pack manufacturing line, use of an independent programmable logic controller for the cutting apparatus, and eliminating the restriction on web cutting to the index rate of the rest of the machining line.

[0021] One aspect of the invention includes a modular cutting station that can be added after market to existing blister pack manufacturing systems.

[0022] One aspect of the invention includes providing a cutting station processor with user-selectable blister pack cutting size.

[0023] Another aspect of the invention includes providing a second index rate for the cutting station that permits cutting of blister packs to the user-selectable size chosen at the processor.

[0024] Another aspect of the invention includes providing an independent programmable logic controller for control of the blister pack cutting apparatus.

[0025] Another aspect of the invention includes providing a compensation loop that compensates for the difference between the first index rate for the entire blister pack machining line and the second index rate for the modular blister pack cutting station.

[0026] Another aspect of the invention includes automatic determination of the index rate of a preexisting blister pack machining system through a communication link and/or handshake between the cutting apparatus' programmable logic unit and the control system for the blister pack manufacturing system.

[0027] In one aspect, the present invention includes automatic determination of the second index rate based on the desired size of final blister packs and the existing first index rate of the rest of the blister pack machining line.

[0028] In one aspect of the present invention, a blister pack manufacturing apparatus is disclosed, comprising a first section including a forming assembly for forming a plurality of blisters in a web material, a filling assembly for placing a desired amount of product in the blisters, a sealing assembly for sealing the blisters after the desired amount of product is placed therein, a first web advance system for transporting the web material between the assemblies, and an electrical control system operative to control the first web advance system; and, a cutting section operative to receive the formed, filled and sealed web material from the first section, the cutting section comprising a blade assembly, a second web advance assembly, a PLC and a user entry terminal for permitting a user to enter data to the PLC, the PLC controlling the blade assembly, the blade assembly to cut the web material to a desired length.

[0029] In another aspect of the present invention, the blister pack manufacturing apparatus further comprises a first web advance assembly which advances the web material at a first index rate, and the second web advance assembly advances the web material at a second index rate, the second index rate being different from the first index rate, the second index rate controlled by the PLC.

[0030] In another aspect of the present invention, the blister pack manufacturing apparatus further comprises the cutting section comprising a web compensation loop arranged to receive the web material from the first web advance system and to retain a predetermined length of the web material prior to being cut by the blade assembly, the web compensation loop compensating for differences between the first and second index rates.

[0031] In one aspect of the present invention, a blister pack cutting apparatus is disclosed, comprising a cutting apparatus, the cutting apparatus including a PLC, a user entry terminal for inputting data to the PLC, a blade assembly, and

a web advance system, the PLC receiving data related to web material cutting size from the user entry terminal, the PLC being operative to control the blade assembly and web advance system whereby precise cutting of the web material is obtained.

[0032] In one aspect of the present invention, a method of manufacturing blister packs is disclosed, the method comprising advancing a web material having blisters formed thereon into a cutting apparatus at a predetermined first index rate; advancing the web materials within the cutting apparatus under PLC control at a second index rate, the second index rate being different from the first index rate; and, cutting the web material within the cutting apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] **Fig. 1** is a cross-sectional view of one embodiment of a blister pack cutting machining station of the present invention.

[0034] **Fig. 2** is an overhead view of one embodiment of a blister pack machining line including the present invention.

[0035] **Fig. 3** is a representation of one embodiment of a blister pack manufacturing system including the present invention.

[0036] **Fig. 4** is a flowchart showing the operation of one embodiment of the present invention.

DETAILED DESCRIPTION

[0037] **Fig. 1** is a cross-sectional view of one embodiment of a blister pack cutting machining station of the present invention. A cutting station 100 in this embodiment takes in blister pack web material 110 via a web advance assembly 115 after, in this embodiment, pre-processing through a forming station, filling station, sealing station and optional perforation station of a blister pack manufacturing line 500 (see Fig. 3). The web advance assembly 115, in one embodiment, constitutes a set of tracks with tensioning

rollers, that carries the web from one machining station to another or within a machining station.

[0038] The cutting station 100 is controlled by a programmable logic controller ("PLC") 120, constituting, in one embodiment, a microprocessor, memory, and storage, and, for example, input and output to the programmable logic controller 120 is performed through a user input device such as a standard keypad and LCD display ("SKD") 130 or a programmed computer (not shown).

[0039] The PLC 120 also optionally includes a communications link 135 for communication with the blister pack manufacturing line 500 (see Fig. 3), or a general-purpose network for remote administration of the cutting station 100. The communication link 135 may consist of any commonly used communications system and protocol, including serial or parallel computer connections, telephone communications via modem, communication over an Ethernet network, wireless network, or a global telecommunications network. The PLC is part of the electrical control box 370, which with a power source 375 drives the cutting station and is discussed in more detail below.

[0040] The web 110 enters a web compensation loop 140. The compensation loop includes, for example, an entry roller 150, a compensation roller 160, and an exit roller 170. The compensation roller is of variable height along a compensation column 180, which is controlled either remotely through the PLC 120 or directly via a manual mechanical control 190.

[0041] Whether remotely or directly controlled, the height of the compensation roller 160 is controlled to compensate for the difference between a first index rate (I_1) 200 at which web enters the cutting station 100 and web compensation loop 140, and a second index rate (I_2) 210 at which web exits the web compensation loop 140 and is cut by the cutting station 100 at the index rate 300. This determination is described in more detail below. In either case, the indexing of web is followed

by a dwell cycle during which processing of the web takes place.

[0042] After passing along the compensation roller 160, and exiting the compensation loop 140 at the exit roller 170, the web enters the central portion of the cutting station 100. A mechanical control box 220 controls the operation of one or more indexing wheels, that as part of the web advance platform 290 advance the web material at the second index rate through the cutting station 100. The mechanical control box 220 uses one or more servo motors 225 to drive the track and wheels and index the web, as controlled by the electrical control box 370 and in particular by the programmable logic controller 120. The indexing wheels are advantageously manually adjustable, and are controlled by a servo motor under the direction of the PLC. In addition, optional perforation wheel assemblies 250 or slicing wheel assemblies 260 permit additional perforation of web 110 and cutting of the web 110 in a longitudinal direction parallel to the direction of motion of the web as it advances through the cutting station 100. Control over the web advance assembly may be accomplished through one or more manual controls 270, although at most times the web advance assembly will be controlled via the PLC 120 and mechanical control box 220. The perforation wheel assembly 250 or cutting wheel assembly 260 are typically driven by gears coupled to the mechanical control box and servo motor.

[0043] Optionally, web advance sensors 280 determine the position and movement of web material 110 as it advanced through the cutting station 100, and wheel sensors 285 are employed to determine the location of the web relative to the cutting station and second index rate of the indexing, slicing and/or perforation wheels 230-260. Thus, the web advance platform 290 advances the web as directed by the programmable logic controller 120 at the second index rate.

[0044] The web material 110 is pulled via the track and indexing wheels 230-240 at the second index rate 210 through the cutting station 100, and into the cutting assembly 300, in

which at least one cutting blade 310 is located. Once a predetermined amount of web is indexed to the cutting assembly 300 at the second index rate 210, the at least one cutting blade 310 slices the web 110. Preferably, the cutting blade 310 consists of a guillotine including a top blade 310 and a bottom blade 320, but the cutting blade 310 may constitute any other controllable cutting blade, including, for example, a single blade, a die cast, a laser, or cutting wheels.

[0045] While the blade 310 typically cuts the web material in a direction transverse to the direction of advance of the web material through the cutting station, the optional perforation wheel(s) 250 and cutting wheel(s) 260 cut the web material in a longitudinal direction (i.e., in the direction of advance of the web material through the cutting station).

[0046] Additionally, the cutting assembly 300 preferably includes an open blade sensor 330 for checking the "open" position of the cutting blade 310, and a closed blade sensor 340 for checking the "closed" position of the cutting blade. Such sensors may be optical sensors, physical position sensors, magnetic sensors, or other similar types of sensors. The sensors preferably send a detection signal to the PLC upon sensing an event.

[0047] Once the web 110 has been successfully cut, it leaves the cutting station 100 via the web advance assembly 115 for further processing, inspection, and/or final packaging. The entire cutting station rests on a base block 380, as well as an at least partial front block 390 which serves to protect operators from the blade and mechanical parts of the cutting station during operation.

[0048] **Fig. 2** is an overhead view of one embodiment of a blister pack machining line including the present invention. Web 110 enters the cutting station 100 through a web advance assembly 115. The web, at this point, is generally continuous and optionally perforated by a prior perforating station (540, see Fig. 3). The web 110 enters the cutting station 100 at a

first index rate (I_1) 200, representing the rate at which the web reaches the cutting station. Between each first index step, there is a rest period during which processing at earlier machining stations takes place.

[0049] The web then enters a web compensation loop 140 where the web compensation loop 140 compensates for the difference between the first index rate 200 used by the prior machining stations and a second index rate 210 to be used by the cutting station 100. In simplest terms, the compensation roller 160 is raised and/or lowered based on the difference between the first index rate 200 and second index rate 210. This movement of the compensation roller 160 along a compensation column 180 typically controlled mechanically via a spring and spring tension, or alternatively supervised by the PLC 120, and allows the tension in the web 110 to remain constant despite the fact that it is moving at different rates on either side of the web compensation loop 140. The web compensation loop 140 takes up the slack web 110 as the difference between the first index rate 200 and second index rate 210 creates slack web over time. Thus, for example, if index rate were measured in inches per machine cycle, the first index rate 200 is 3 inches per cycle, and the second index rate 210 is 2 inches per cutting cycle, then the web compensation loop 140 could take in 3 inches of material at the first index rate, and dispense that material at the second index rate to the cutting station 100. Alternatively, the PLC may compute the least common multiple as between the first and second index rate, and accumulate that amount of material before releasing it to the cutting station at the second index rate. Thus, even if the cutting station has a second index rate greater than the first index rate of the blister pack machining system, the web compensation loop can collect multiple indexes of web material at the first index rate, and dispense web material at the second index rate when sufficient web material has accumulated in the compensation loop.

[0050] The web is then moved at the second index rate 210 via a set of indexing wheels 230-240, including top indexing wheels 230 that contact the top of the web, and bottom indexing wheels 240 that contact the bottom of 1the web. In addition, perforation wheels 250 to perform perforation as needed to the web in addition to, or in replacement of, a perforation station, and cutting or slicing wheels 260 may be used to cut blister web in parallel to the direction of motion of the web. The resulting perforated web 350 goes on to the cutting assembly 300.

[0051] The web is then cut at the cutting assembly 300. Once the web 110 has been indexed at the second index rate 210, the cutting blade 310 or blades 310-320 slice the web 110 to form cut blister packs 350. While any blade may be used, a guillotine comprising two blades, one above and one below the web material, closed together upon cutting the blister pack, is preferred. Finally, the cut blister packs 350 are transported via the web advance assembly 115 for additional processing, inspection, and/or final packaging.

[0052] Based on the above system, a cutting apparatus can be programmed to cut at virtually any index rate, and hence at virtually any final blister pack size, relative to the first index rate, without the need to retool the cutting apparatus or revise the entire blister pack manufacturing system. Furthermore, the programmable logic controller can provide more advanced features, such as an adjustable second index rate that advances web material through the cutting apparatus at a variable but repeating pattern of different indexes to create custom blister pack shapes and sizes.

[0053] **Fig. 3** is a representation of one embodiment of a blister pack manufacturing system including the present invention. A blister pack manufacturing line 400 includes a forming station 410, a filling station 420, a sealing station 430, a perforation station 440, and a cutting station 450. Web material is advanced from one station to the next, and

within each station, via a web advance assembly 460a-f. At the forming station 410, a first index rate 200 is typically set for the majority of the blister pack manufacturing system 400. The web material 110 is advanced between each station at the first index rate 200, and within each station the web material 110 is operated on at the first index rate 200 or a fixed timing based on the first index rate 200. However, when web material 110 advances via web advance assembly 460e into the cutting station 450, it enters the web compensation loop 140, wherein the difference between the first index rate 200 and second index rate 210 is compensated for. Within the cutting assembly, web material 110 leaves the compensation loop at the second index rate 210 and advances along the web advance platform 290. After cutting, the web material 210 leaves the cutting apparatus 450 via the web advance assembly 460f for later processing, inspection, or packaging.

[0054] **Fig. 4** is a flowchart showing the operation of one embodiment of the present invention. After a beginning state 500, the PLC 120 first receives data related to a web material cutting size 585 from a user in a cutting size receiving step 510, either from user entry via the keypad and display 130, or via a communications link 135 to a larger blister pack manufacturing line or general communications network. The data related to a web material cutting size 585 is, for example, the actual web material cutting size 585, a second index rate 210 to be used by the cutting apparatus, cutting assembly, and web advance platform, or the second index rate 210 or web material cutting size 585 expressed as a relation to the first index rate, such that for a first index rate I_1, a second index rate I_2 is determined by a user entry of a value x functionally related to the first index rate and the second index rate, such as, for example, where $I_2=I_1/X$. Advantageously, in this embodiment, X can be any non-zero value, and is foreseen to, in some embodiments, be greater than or less than one (thus sometimes resulting in a second index rate greater than the first index rate). In some

embodiments, when the web material is cut one-to-one with the second index rate 210, the second index rate 210 and web material cutting size 585 will be related, or equivalent, depending on the measuring units used.

[0055] The PLC 120 then receives a first index rate related to the larger blister pack manufacturing line in a first index rate receiving step 520, in a similar manner to the blister pack cutting size step 510. Based on, for example, the first index rate 200, blister pack cutting size, and the geometry of the cutting station 100 and cutting assembly 300, the PLC 120 then computes the second index rate 210 necessary to index the web through the cutting station 100 in order to create cut blister packs 360 at the requested blister pack cutting size, in a second index rate computation step 530. The PLC 120 then adjusts the web compensation loop 140 to compensate for the difference between first and second index rates, in a web compensation loop adjustment step 540. Alternatively, the second index rate may be directly obtained or received by the PLC 120 via user input or over a network in a second index rate receiving step 525.

[0056] The web is moved at the second index rate 210 over indexing wheels 230-250 and optionally perforation wheels 250 or slicing wheels 260, all of which are adjustable as needed depending on configuration of the cut blister packs 360 and perforated blister packs 350 to be created.

[0057] Once the web enters the cutting assembly 300 in a web advance step 550, a first blade sensor detects the position of the blade 310 when open in a blade position sensing step 560. The blade or guillotine 310 then cuts the web at the predetermined location determined by the PLC, in a web cutting step 570. The PLC then, in one embodiment, checks the second blade sensor to determine whether the blade closed, checks to determine whether the cutting job has been completed, and checks to determine whether any error conditions have occurred, in a end/error condition check step 580. If no error condition or end condition is met, the PLC

loops back to the web advance step 550 (or, if necessary, the web compensation loop adjustment step 540), and continues looping through these steps until all web is cut, the job is completed, or an error condition arises.

[0058] Error conditions are typically monitored by the PLC. If any of the sensors detect an error, they send an error flag to the PLC which, when checked 580, causes the cutting station to halt operation. Alternatively, the PLC can send an error message to the end user though the keypad and display 130 of the error condition, and can send or receive error flags through the communications link 135. Similarly, the PLC can halt cutting station 100 operating upon receipt of an error flag from the general network or blister pack manufacturing line over the communications link 135.

[0059] Through the web compensation loop 140, the communications link 135, and the standard web advance assembly 115, the cutting station 100 can thus be added directly, or as an aftermarket replacement, to an existing blister pack manufacturing line.

[0060] In one embodiment, the cutting station is designed to produce several blister package configurations and package sizes depending on a specific blister pack form and blister pack seal pattern configuration without need to change over the cutting tool. This is achieved after utilizing a specific forming and sealing tool on the blister pack machining line. In particular, the cutting station allows for adding or adjusting perforating and or slitting wheels on the cutting station and, with user input of end package length and the number of packages to cut per cycle through the keypad and display (or operator interface), virtually any size of final blister package can be cut without need for substantial retooling.

[0061] To initiate operation, a user-defined recipe is selected through the SKD from the programmed PLC. Initial

threading of the blister web produced from the blister machine is preferred.

[0062] As the existing blister pack machining line indexes the blister web into the cutting station, a web compensation loop in the form of a compensation loop takes up the slack. At the end of the machine index of the web, during the dwell cycle, a signal from the blister pack machining line will typically be sent to the PLC via the communications link. After the proper amount of blister web has accumulated in the compensation loop, with no error flags (including safety faults) existing, a proximity switch or sensor will enable the cutting cycle. The cutting cycle will consist of driving rollers pulling the proper length of blister web through the slitting and/or perforating wheels and into the cutting assembly at the second index rate. Web advance assembly tracks, preferably specifically designed for blister web patterns, will advantageously guide the web through the cutting station.

[0063] The cutting cycle will repeat until ended by the PLC at the end of a programmed job, at the end of the web, or due to an error condition. The guillotine will have a sensor to indicate the guillotine in its open, or "home" position and a sensor to indicate that the blade is in the down, or "cut" position. Finished cut packages/strips directed to the blister package manufacturing line web advance assembly along an exiting track.

[0064] The cutting station is controlled through an electrical control enclosure typically mounted to the cutting station itself. It has been found that the electrical control enclosure is advantageously run at a voltage of 220VAC, single phase. A main power switch is advantageously placed on the electrical control box permitting the machine to be easily turned on and off. Another two-position safety switch typically disables and enables the guillotine cutter. The SKD is typically contained in the electrical control enclosure, and is preferably mounted on the door.

[0065] By using the keypad on the SKD an operator is able to enter a numerical value for the package cutting length and the amount of packages in the index (or first index rate) into the PLC. These values are then stored in the PLC memory. Based on the keyed-in package length, the PLC will perform the necessary calculations to enable the servo motors in the mechanical control box to advance the web with the proper feed length. Also, a counter in the PLC's programming advantageously references the keyed-in number of packages and counts the cutting of the specified package count.

[0066] Through a creation and editing cutting format, entry of this data into the PLC through the SKD produces recipes that can later be referenced or reused for later web cutting jobs. The transfer of data between the PLC and servo drive motors running the cutting station is typically via ASCII control commands sent over a standard RS232 serial connection. In one embodiment, a proximity switch and two blade sensors, described above, will control and verify proper operation of the cutting station. The PLC, in one embodiment, signals a solenoid valve to activate an air cylinder with a cutting blade attached, to drive operation of the blade. In particular, an air pressure of 120PSI has been found to be sufficient to drive the guillotine blade.

[0067] The cutting station advantageously mounts in an existing blister machine die cut station. The principal parts of the cutting station, that will house the gear and pulley drive mechanisms, are mounted to the base block of the station. A servo motor is the drive source for indexing of web through the cutting station. In particular, there are, in this embodiment, two guide rollers to assist in blister web material tension. Also mounted on the base block is a web compensation loop in the form adjustable height compensation loop assembly, consisting of web idler disks, vertical linear shafts, bearing blocks & set bracket with a proximity switch.

[0068] The removable slitting wheels and shaft assembly can also contain optional feed direction perforating wheels. The rubber drive roller wheels which index the web and the shaft assembly of the cutting station are mounted as well, and this assembly can be removed for set up, configuration or repair of the cutting station. The guillotine blade itself is attached to the upper cylinder & valve mount plate and clamped between the front block, base block and spacers. An additional electrical connection box mounts to the top of the base block. It is recommended that the cutting station include safety guards.

[0069] In order to change the configuration of the cutting station, in one embodiment, a simple process is followed. First, switch the power off on the electrical control box as well as any pneumatic air connection required for operation of the guillotine, remove slitting wheels and shaft assembly as well as the rubber drive roller wheels and shaft assembly. Then, insert the specific indexing wheels, perforation wheels and/or slicing wheels as needed for the configuration of blister packs to be created. Then, replace the unit parts for operation on the new line.

[0070] To operate the cutting station in one simple embodiment, simply index the blister package machining station until enough formed blister web is accumulated to feed through the entire cutting station. Then, with the power off on the cutting station, manually turn the manual indexing control clockwise and feed blister web through the cutting station placing web in position under the knife at the position for cutting. The web sensor should typically be over the lead edge of a blister. Then, Turn the power on, and set the height of the blister web accumulation loop via the manual accumulation control or via the PLC. From the SKD select the number of cuts per index (via either the first index rate or the second index rate) and the package length. It may be necessary, in some instances, to fine-tune the cutting of the knife by repositioning the fiber-optic eye. Once these

configuration steps have been performed, either manually or automatically, the cutting process can proceed.

[0071] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.